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which they have not yet wholly recovered. But England ought to take warning, even from that feeble, irresolute, not to say ludicrous attempt, — especially now, since she has received such a terrible lesson from India, — rather than turn it into ridicule, or exult so triumphantly in its failure. She ought to bear in mind now, if never before, that the tempest threatens before it breaks, that houses creak before they fall, —

“*Tempestas minatur antequam,
Crepant ædificia antequam corruant.*”

ART. VI. — *Principes d'Ostéologie Comparée, ou Recherches sur l'Archetype et les Homologies du Squelette Vertébré.* Par RICHARD OWEN. Paris. 1856. 8vo. pp. 440.

FROM the night of early history there have come down in single words visions of wonderful greatness, — the fragments seemingly of another world, mysteriously vast, and after all little else to us than mere words without definite ideas. Of their true history, of their epoch, or of their locality, we know nothing sure, and at times their very existence as former realities has been doubted. Among such words are Babel, Nineveh, and Troy; but a few years ago wholly unknown, yet a part of all our history, and associated with scenes of violence, might, and glory, magnificent as the clouds of heaven, and like them obscuring all that lies beyond. If these faint glimpses of the past may raise such deep interest, we can appreciate the excitement of Eastern discovery, where the explorer even hopes to find the spell by which to raise from the dust around him the ghosts of those older than Samuel, and to bid them speak. But as it is with the traveller, when after long search the ancient city itself stands before him, alone amid the sand-hills, and perfect in its record of former life and greatness, so is it with the student of the human body when contemplating for the first time the vast edifice of comparative anatomy. The fragments and half-inscriptions of special dissection have, with all their addition to our real knowledge,

but stimulated the search for the temple of which they are mere blocks. As architecture expresses ideas of a nobler sort than the mere power shown in its massiveness, so the highest thoughts in anatomy arise from the consideration of intellect expressed in its forms and in the principles of their being. These deeper meanings constitute what we may call the poetry of anatomy. It may be difficult, and perhaps is impossible, to make these principles of anatomy stand clearly by themselves in the mind of the popular reader, in their full proportions of strength and beauty, and divested of their common associations; but it is not here that we apprehend the greatest difficulty. The language of architecture is so far common, that when the vast blocks of stone are measured, and the pillars described, we all form to ourselves some idea of

“ Palace bright,
Bastioned with pyramids of glowing gold,
And touched with shade of bronzed obelisk,

Arches and domes, and fiery galleries.”

But the anatomist knows as yet no common language, and any degree of explanation seems to the general reader the material of dry, and perchance disgusting study. And as in the one case the description, however vivid, raises in the reader but a faint and limited emotion, compared with that the traveller experiences when looking up from his watch-fire to the stars whose light has fallen in those empty streets since man and beast were there thousands of years ago; such, and even greater, is the difference between the emotions with which the philosophical anatomist and the general scholar view that foundation of form, the skeleton.

To carry out our illustration, let us consider, in these foundation-stones of being, their *material*, and the *conditions* under which they must be put together. Man builds of wood, clay, brick, or stone, as he would have less or greater firmness and permanence of structure; but the body is built of one material, which, like the genii of Eastern fable, takes upon itself each nature in succession. The hard, white bone was once soft tissue, that could “in many a freakish knot have twined”; and the Nature that so tenderly placed these “ozier wands”

“ Framed a spell when the work was done,
And changed the willow wreaths to stone.”

But more than this, if we could look within the growing body, we should see that, while the cartilaginous pillars and domes of life are hardening here and there under that magic spell, they are also rapidly developing in size, and thus lifting the edifice into grander and more perfect proportions, as though man should cut in miniature what should thence expand into an ever greater magnitude for finish and adornment. It is the triumph of the painter's eye and skill, that, working on a large surface, he can so far carry the whole design in his mind as to complete each individual part in entire symmetry. But Nature draws the beautiful outline on a small scale, and then, while it grows, from moment to moment reconstructs the details in harmony and with microscopic nicety. In her wonderful art, too, she often seems to court difficulty by making the first outlines wholly different from the finished piece, and to stretch the canvas where human painters would erase and begin anew.

As man, so Nature has built for land, for sea, and for the air; and though of this one material, bone, with a far more certain tenure. Think of a human being drifting away in a storm, his frail seat hung by a few threads to the silk globe above him, suddenly finding himself, as the clouds clear away, far over the ocean, and the valve-string by the swelling of the globe swung out beyond his reach. Imagine the awe with which, as he attempts to climb round the network, he sees that his struggles are pushing the globe slowly out of those threads. Then turn to some mountain-top, where, as you cling to the cliff and look down on lakes as little flecks of silver light, and forests with their mighty roar as an ocean stranded below, a shadow flits over you, and a mighty rush of the air that makes your heart beat quick, and the eagle you had seen an hour ago sailing above passes downward, is lost in the distance, and then comes slowly back with his prey to his eyrie. Thus for air, no less than on sea and land, Nature has been the safest architect.

It has been said that a geological map of any country will at once indicate the style of architecture which must prevail

there, and that the climate will indicate each detail of moulding and decoration. Nor is this wholly absurd; for it simply means that man builds in harmony with the nature of things around him, at least so long as he builds from necessity alone. Thus it is plain that a country abounding in coarse rock will encourage a very different style from that which furnishes fine and easily cut stones; for in the one case, fragments of unmanageable forms would necessitate a rustic rudeness, while in the other large shafts and blocks would rise in polished symmetry. Thus, again, a humid climate introduces the concave moulding, or dripstone; while clear and brilliant skies bring out the convex style for color and show. Equally does Nature reverence her own laws of mechanics and physics, when she constructs living houses. Man builds the ship, for passing through a dense fluid, of the shape that will the most easily divide it and throw it back; while on land, in the rail-car, he disregards the resistance of the lighter atmosphere; but in all this he was preceded by the hand which formed the darting fish and the broad-chested horse.

If then there is this harmony, a perfect apprehension of the laws that govern forms would enable us to assert the conditions of any previously unknown figure. Thus, it is easy to see that the wide rampart is meant to resist outward pressure, whether it be that of a beating sea or of the "iron hail"; and a slight inspection will show for which of these purposes it is designed. And so anatomists find that the habits of an animal are indicated in its structure, exactly in proportion to their comprehension of that structure, and of the great laws of Nature to which it is subject. Yet so varied and *natural* are these adaptations, that they were hardly noticed till comparison in the hands of Cuvier brought out distinctly the variations of a type under different conditions, and thus laid a sure basis for the science of paleontology.

What is it that moves the animal? Every one who has looked through a microscope at a little stagnant water will remember seeing single cells that floated about apparently at will, now contracting, now lengthening, or perhaps suddenly shrinking away from the approach of other atoms. And he may remember the surprise with which he heard that those

cells were plants. But if he continues his examination, he will gradually see that some show more choice and free-will than others, and these he finally sets down as animals governed each by its own little spirit of instinct or reason. Now when he comes to inspect the muscle that moves the body, he finds it made up of thousands of these little cells joined end to end, and harnessed in traces composed of thin membranous tubes, millions of which are put together to serve the "tyrant man." But how does man govern these pigmy trains? From the head thin white reins pass down to each of them, and as they work in the dark caverns of the body, lengthening and contracting in the glossy tubes through which they can dimly see their fellow-gnomes rushing to and fro, they are thus held in the leash of obedience, at least for a time; though when *we* die, they are free in grand carnival till they starve, and sometimes they break out in open rebellion against their living lord. But since each cell can contract very little of itself, the longer their train, the greater is the amount of their motion; and the larger their mass, the more powerful their force. Thus if each cell could contract the thousandth part of an inch, it would take a thousand in line to move the end one inch. Yet their mass is not altogether as a body of men pulling, for careful examination has shown that they can be tired, and as one row drops off another begins to work; thus in a steady pull alternating through the whole set. In proportion to their thickness they must have breadth of standing-room, and thus from their mark on the bone we can judge of their power, and from the length of the bone of their velocity. And as a slight motion at the hinge of a door will give great speed beyond, so the muscles are crowded nearer the joints in the antelope than in the camel, and in the hinder legs of the horse than in those of the ox. Thus, again, we see that the several members agree in their structure with the whole, and also that all these peculiarities of fabric are mere harmonies with the plainest mechanical laws, yet so hidden beneath their simplicity that only the tokens of variation from one condition to another have given us some few of their chords.

But beyond this, as physical and chemical laws are now as
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they were ever, from the marvel it has become the truism of science, that the anatomist is able in the light of such principles as he can evolve from present beings to build again from one single fragment the forms that lived ages ago. Thus, for example, let us consider the last or nail-bearing bone of the middle finger. We can judge at once whether it was part of a fin, a wing, or a hand. Supposing we find it neither fin nor wing, we can then carry the determination further, and from the mark left by the nail ascertain whether it was part of a true hand, or of the scratching palm of the dog or bear, or of the tearing and springing paw of the lion or tiger, or of the long and hooped foot of the horse or deer. A similar examination soon ascertains its nature in every other particular. Again, when we see the broad tail of the fish placed vertically, and that of the whale horizontally, we know that, as it is the chief instrument of progression in both, and exerts its power from side to side of its plane, therefore the first can have but comparatively slender capacity of diving, and is limited to a narrow range of ascent and descent; while the latter has this capacity in excess. Hence it follows that, as in the rediscovered city, the vases, mirrors, paintings, and all the nameless appliances of civilized life, show by their perfection and evident use the customs of a forgotten nation, so may the shapes and apparent fitnesses of the bones indicate the habits of the former life that clothed them, and even the physical condition of the world in which they had their sphere of activity. What an immense volume is thus opened to the imagination, those only can tell who have travelled over continents to unfold but a few leaves of geology in history, each with its million-voiced story of life.

Says one who visited the excavations of Mr. Layard at Nineveh, after describing his journey over the plains at sunset, when the sky was glowing pure and cloudless with the last light of day, while the dark shadow of the great mound lay on the plain, and from the evening mist rose faintly the bleating of sheep and lowing of cattle as they returned from pasture:—

“It was of course with no little excitement that I suddenly found myself in the magnificent abode of the old Assyrian kings, where it

needed not the slightest effort of imagination to conjure up visions of their long-departed power and greatness. The walls themselves were crowded with phantoms of the past, unfolding in vivid representation deeds of peace and war, of personal history and national welfare. My mind was overpowered by the contemplation of so many strange objects ; and some of them, the portly forms of kings and viziers, were so lifelike, and carved in such fine relief, that they might almost be imagined to be stepping from the walls to question the rash intruder on their privacy. Then mingled with them were other monstrous shapes, — the colossal forms of winged lions, and bulls with gigantic human faces ; and all these figures, the idols of a religion long since dead and buried like themselves, seemed actually in the twilight to be raising their desecrated heads from the sleep of centuries.”

It is thus that three thousand years lie buried a few feet below the soil. Yet after all, Nature alone is ancient, and man is but a modern invention. Let us now visit a buried city of another kind. As the traveller passes over the open, monotonous prairie, where in the distance the dark range of the Black Hills barely edges the horizon, he suddenly comes to the brink of a valley that looks as if it had sunk away from the world about him, leaving over it thousands of lofty columnar masses. Says one : —

“ As it appeared in the distance, never before did I see anything that so resembled a large city ; and so complete was this deception, that I could point out the public buildings by their domes and large roofs, and with them were rows of palaces great in proportions and number. Indeed, the thought frequently occurred to me as we rode along, that we were approaching a city of palaces, with everything upon the grandest scale, and fitted for giants who might have ruled the huge animals whose remains are there still, rather than the pygmies that now inhabit the earth. Again and again, as from different positions this region was visible, thoughts of an immense city would arise in my mind, and I could almost fancy that its din and bustle were occasionally borne upon the wind to my ear. But on descending into the valley, and threading its vast labyrinth, the castellated forms vanish, and on every side appears bleak and barren desolation.”

Yet not wholly so. As we view the sides of one of those fancied walls, layers of pink and white clay are seen, and here and there a bone protrudes, telling of life as once there, — a life that needs long and careful study to show what its

world was. The little examination that has as yet been made tells, however, a marvellous story. The animals that seem to have been most numerous were enormous swine, not unlike our present tapirs, that swam and fed in a peat-marsh; and with them were immense turtles, some of which, as they now stand in their mail, like the Skeleton in Armor, are supposed to weigh a ton. What great, ungainly forms their contemporaries were, we can perhaps imagine when we find the row of teeth along one jaw five feet in length, and remember that there must have been a correspondingly long and heavy body to balance this determination to the head.

Here again, as in viewing ancient temples, if we knew how long it took to lay one stone upon another, we might form some idea of the time the whole was in building, so we might study to the same purpose these strata of clay. When we think of the slow filling up of our ponds, of adding layer on layer till three hundred feet are thus built up, and remember that this great mass of more than ninety miles in length and thirty in breadth, like the Pyramids of Egypt, is one vast sepulchre of a race now wholly dead, we shall appreciate in some measure the true history of life. And yet this is but one very modern edifice, reared on the ruins of older and vaster buildings, which were themselves preceded by many a greater temple and longer reign.

As the reader inspired by the Muse of History can picture to himself the deeds and scenes of the past, so also does the anatomist conjure up the aspects of other days, when viewing these monuments of life. The animals of the present time, with their land and forest homes, wax dim, as in the magic lantern; but, before quite vanishing, they come back again in gigantic and grotesque shapes. Thus, the elephant reappears in the mastodon; the elk, in that gigantic fossil whose horns measure twenty feet; the sloth, of less than human size, in the megatherion, whose mere width exceeds man's stature. These again vanish, and are succeeded by forms more strange, till, as in a nightmare, affrighted fancy weaves a cloud-veil for those vanished ages, and would fain believe the then world, as too terrible for view, wrapped in perpetual

night. And when with this change of animal life the changes of vegetable growth are associated, and the two bound together by the vast movements of the Earth's crust, which, rising and falling like some living breast, thus nourishes her children, then the scientific dreamer brings before him grandeur which imagination cannot transcend.

We have now seen the bones in columns, walls, and roofs, rising like enchantment from the ground, while the muscles, verifying the myth of Briareus, reach out their hundred arms from windows and doors to give the edifice motion. And so far we have traced harmonies which man can not only appreciate, but use as the key to greater mysteries; for when with this key we wander amid the shadows of the temple of Nature, we come upon a figure, meaning something, no doubt, as all figures do, yet which seems to bear the inscription of Isis: "No one shall lift my veil." Anatomists find that wherever bone has been used, there the body is built about a central pillar of blocks, called *Vertebræ*; that is, if we find a fragment of bone, however small, from the simple fact that it is bone, we can conclude one important point of its structure, namely, that it was no part of an animal like the lobster, crab, beetle, or worm, — the cuttle-fish, snail, or oyster, — the star-fish or sea-urchin. Bone, in fact, forms the support of the body only in that great natural group called *Vertebrates*. Now, why is this? The worm and the snake seem much alike; the fish lives in the same element with the sea-nettle, and the fly and the bird might seem as one, if their destination alone planned their forms. And yet snake, fish, and bird are of one structure, while worm and fly are of another. Again, among these *bone-animals* we find two great groups, equally arbitrary and incomprehensible in their division, the viviparous and the oviparous. In the former, we find on the shoulder-blade a high ridge called the spine, and in the neck we find seven of the *vertebræ*. And this last is the more remarkable, when we consider that man's neck of only six inches in length, the giraffe's of as many feet, the rat's, the elephant's, and the whale's, all maintain this identity. What mean these facts, apparently transcending adaptation to follow an idea?

In the case we have already referred to, the position of the tail in aquatic animals, we find another illustration of the fact that the groups of vertebrates are distinguished by characteristics which are not merely mechanical adaptations. The tail seems in the first group, or the Mammalia, whenever they are fitted to move in the water, to be flattened out horizontally; but in the egg-born group, to be always placed vertically. Now, we have already shown that the former structure is well fitted to the habits of the whale, which passes through so great variations of depth; and it might seem as if the following such an idea in the formation of an animal would determine that only the Mammalia could occupy great ranges of aquatic depth. But we find in a fossil reptile a powerful tail placed as the egg-born should have it, and yet a power of diving secured by a full development of broad paddles in the hind and fore legs. And thus it is ever with Nature, that her seeming limitation only shows the infinity of her resources.

Any one who has ever looked at the skeletons in an anatomical museum, or even at the vertebræ of a fish, a bird, and a sheep or ox, will remember that they seem to be alike only in that they are made of bone, and of separate pieces. What a confusion lies here! The little hourglass-like blocks of a cod-fish, curiously and beautifully carved, with the deep hollows on each end where the sands of life seem to have run; the rough lumps from the neck of a hen, with their spines and ridges; the cubes of the sheep, with a few broad blades on each side,—what can be more dissimilar? Does it not seem as though they who built these forms, wise though they were, took each his own type, one a Gothic pillar, another a Grecian, to form the centres of their separate works. But be that as it may, they all agree in having a head at the end of the spinal column, much like the capitals of our human architects. And though these seem to coincide no more in bone than in stone, yet we can find some groups that are evidently by the same designer.

Since the bones were once cartilage, we might expect to find in the young skull before it is ossified the outlines of the bones that are to be. But when we examine, we see only a dome of cartilage, with here and there a little white

spot of bone-crystal; and as we gaze upon the blank, "unformed chaos," we feel much as the child would when looking first into the dome of night, where the numberless stars only amaze and perplex him. Yet as we watch again and again in that night of anatomy, we find these stars of bone shooting out little filaments like freezing water, till, covering the whole, they emerge to light as individual bones. Thus, as the child by long observation of the stars traces a system in the movements of apparent confusion, so do we come to an order amid this labyrinth. And as the savage who has learned the stars plunges boldly into unknown forests, and pursues their guidance over mountains, so does the anatomist, following the stars of growth, find his way amid the mystery of creation, where he seems almost to

"Touch God's right hand in that darkness."

How much this observed development has done to clear up anatomical difficulties may easily be seen, when we know that in the fully formed skull we find in some cases one bone where in others we find two, and this not only in unlike animals, but in those of the same group. And when the separate stars of ossification have been mapped out and compared, and we find two uniting to form one bone in one skull, and remaining distinct as two bones in another, we see then the unity that grows up into variety, just as we find the stars for ever the same by night, while the light of evening and morning blends them together, leaving but here and there one distinct orb. And as with the capital, so with the pillar, both Grecian and Gothic are at bottom the same.

How different then the view of the skeleton to the common mind and to the philosopher! To the one death grins foully in the rattling bones, while to the other thoughts of sublime mystery haunt the ruins. Who can tell why bone should be restricted to one peculiar pattern, or a particular number and form to any single group? Man may apprehend the symbols and ideas of dead nations, since the human mind originated them; but it must be a mind akin to that of the Creator that can determine point for point why this creation is as it is. And here, if sublimity lies in the region of the visible and yet

immeasurable, there surely is sublimity when, in tracing these hieroglyphs of His inscription, we come suddenly upon a thought readable, but too deep for comprehension, yet which we may hope to reach in other realms of being, since we are made in the image of His own immortality.

ART. VII. — *Currency or Money; its Nature and Uses, and the Effects of the Circulation of Bank-Notes for Currency.*
By a Merchant of Boston. Boston: Little, Brown, & Co.
1855. 8vo. pp. 112.

THIS pamphlet, anonymous on its title-page, bears affixed to its Preface the initials "S. H.," which, it is well known, designate Samuel Hooper, whose experience as a merchant, financier, and legislator might give weight to his opinions, were they not sustained by reasonings in themselves satisfactory. Had the work fallen into our hands when it first appeared, we should have promptly noticed it. We did not know of its existence till the forecast shadow, which it announced as already lowering over the seeming prosperity of our mercantile estate, had become apparent and portentous to every eye. It is a searching analysis of the basis of our currency, the elements of its value, the causes of its fluctuation, and the effects of that fluctuation on the course of trade, the profits of capital, and the wages of industry. It announces, indeed, only such truths as have become axioms in political economy among its French expositors; but it has been our unenviable distinction on this side of the Atlantic, that our legislators, bankers, and merchants have demeaned themselves as if the science of finance were still wholly empirical, and they the pioneers in its test-experiments.

Our last number appeared during the most disastrous paroxysm of alarm and distress that has as yet marked the monetary history of our nation. The panic has now subsided, leaving us in an entirely altered condition, with crippled industry, diminished prices, and a contracted currency.